



## With Maturity Comes... Better Taste?

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While the left-coast furor over hang time and extended maturation rarely visits our cool-climate shores, New York is certainly feeling the heat this year. In the last three issues, both our analysis numbers and reports provide ample evidence that the warm weather in 2010 has resulted in early ripening and potential for longer overall hang time. Instead of the bright, lively, stillgreen- behind-the-pedicels fruit typical to our cool climate, winemakers are preparing for grapes more likely to exhibit mellow acidity, a richer, lush palate- characteristic found in grapes 'of a certain age.' For the first time in years, New York is dealing with a harvest that is decidedly mature, and, in some cases, may even have the potential for over ripeness.



How should winemakers used to a certain level of immaturity deal with this year's crop? First, rejoice – this is a year to leave the potassium bicarbonate in the lab cupboard and experiment with higher sugars and different flavor profiles. Once the elation passes, however, there are a few aspects of 'not-quite-so-cool' climate winemaking that it might be helpful to review.

**Elevated sugar levels:** Clearly, more mature grapes means higher soluble solids. There's nothing mysterious about this increase; it's the same glucose and fructose found in less-ripe grapes, and usually at the same glu:fru ratio-there's just more of it. Higher sugar concentration leads to either higher final alcohol or, if fermentation is arrested prior to dryness, residual sugar and/or enhanced viscosity. While all of this seems obvious, it's important to bear in mind that ethanol is a primary contributor to a wine's sensory profile. In addition to enhancing perceptions of heat, sweetness, and palate weight at elevated levels, there is some evidence that ethanol may suppress perceived intensity of some fruity esters. Further, there are always the twin issues of taxation and labeling that arise when final alcohol is greater than 14%.

**Nitrogenous compounds:** The various components of yeast assimilable nitrogen (YAN) and the amino acids used as precursors for some aroma compounds fail to show a common trend during grape ripening. YAN concentration varies more by site and cultivar than by physiological age, as evinced by the range of numbers found in the data charts this season. Individual amino acids generally tend to increase during ripening, but rates have been found to vary by individual amino acid and cultivar.

**Acidity and pH:** Throughout ripening, TA decreases (due to decreases in malic acid content) with a subsequent rise in pH. As these parameters were discussed in detail in the last issue, suffice it to say that these changes affect palate balance, and can give microbial pests a toehold.

**Phenolic compounds:** Beyond anecdotal evidence, little is known about the effects of grape maturity on phenolic development- at least in terms of sensory impact. Enologists generally agree that seed tannins become less extractable post-veraison, and that the mean degree of tannin polymerization increases, but the impact of these changes is not clearly understood. In sensory evaluations, one panel rated wines made from riper red grapes as having 'softer' tannin character, while another felt that riper red grapes resulted in more bitter wines. In some white wines, the increased polyphenolic content that occurs with berry ripening has resulted in decreased sensory quality scores. It is unclear, however, whether these changes are due to phenolic composition, interactions with other wine components, or all of the above; the lower acidity in riper grapes, for instance, will reduce the perception of tannin astringency. As with so much wine chemistry, differentiating the effects of phenolic changes from those of other parameters (like decreased acid, increased ethanol, and changes in volatile compositions) is difficult to impossible.

**Volatile compounds:** The multitude of chemical classes that constitute wine flavor, and the numerous reactions from which they derive, make it impossible to issue blanket statements on the effects of ripening on flavor development. The flavor chemist's motto, "Flavor is a point in time," holds true in grapes and wine as in any other flavor system. A review of the literature illustrates the lack of uniformity found in the developmental trends of key classes of aroma compounds. Further, many of the grape-derived flavor compounds in wines exist as bound precursors in grapes, and thus are challenging to assess by sensory analysis.

*Monoterpenes* are critical to the floral aroma of Gewurztraminer, Traminette, and Muscats, and can also contribute to the character of other aromatic cultivars like Riesling, Albariño, and Vidal blanc. Monoterpene accumulation begins at veraison, but the behavior of individual compounds is inconsistent; some concentrations peak at 4-5 weeks post-veraison and remain constant for the remainder of ripening, while others increase for as many as seven days after sugar accumulation slows, and still others show decreased concentration during extended maturation.

- *C6 Compounds.* C6 compounds are responsible for the "grassy, green apple" aromas of freshly crushed grapes. These compounds are produced enzymatically during grape crushing, and will be the dominant aroma compounds in many varieties, especially in immature grapes. However, many of the C6 compounds are transformed into less odorous compounds during fermentation.

- *Methoxyphenols* are well known for their green or herbaceous character, especially in traditional Bordeaux varieties. Pre-veraison, the accumulation of MPs is correlated with increased vine growth, lower croploads, and shaded clusters. However, it is not clear what factors control MP degradation rates beyond grape maturity, as recent research at Cornell indicates that cluster exposure post-veraison does not affect MP degradation rates. Thus, grapes that accumulate more MPs early in the season are expected to need longer hang times post-veraison for MPs to decrease to a desirable concentration. It is easy to confuse the musty herbaceousness of MPs with the grassiness of C6 compounds; for a comparison, try sampling unripe Pinot noir or Syrah.

- *Volatile thiols* are responsible for the varietal notes of boxwood, grapefruit, and guava in Sauvignon blanc. However, they are also above threshold and likely contribute to the fruity aromas of many other wines, including Riesling, Gewurztraminer, and roses. Volatile thiols also evolve during fermentation from grape-derived precursors, although it is reportedly possible to observe the thiol potential in Sauvignon grapes following chewing and swallowing due to microorganisms in the mouth. Winemakers and scientists agree that optimal ripeness in Sauvignon blanc is achieved for only a day or two, and that overripe grapes lead to loss of varietal character. Little research has been performed, however, beyond early work that found one volatile thiol to increase throughout ripening.

- *Rotundone* increases post-veraison, and contributes a black pepper note to such cultivars as Syrah, Lemberger, and Bordeaux varieties. Rotundone may also be responsible for the black pepper aroma of Noiret.
- *Sugar degradation products*, such as furaneol, sotolon, and related compounds have been reported in higher concentrations in some raisined wines, but evidence is spotty due to the difficulties in accurately measuring these compounds.

**Sensorial impact:** Outside the realm of chemical analysis, sensory studies have indicated that the overall changes in grape maturity can impact consumer acceptance of wine. One study found that all aromas were ranked as less intense in Riesling wines produced from fruit allowed to hang beyond traditional harvest time. Other sensory tests have resulted in lower quality ratings for wines made from Chenin blanc, Pinotage, and Cabernet Sauvignon harvested later than considered 'normal' for their region. Winemakers in most regions find that there's a 'right' time to harvest each variety in their region, and that time may not be 'as ripe as possible.'

This all leads back to the same old advice: for the best picture of ripening, taste fruit early and often. With such a variety of volatile compounds changing at different rates during maturation, sensory evaluation is the only way to get any idea of grape flavors. It's important to remember, though, that many volatile compounds exist as odorless precursors, so the character of the wine won't be completely reflected in the grape. But then, isn't winemaking always about the perfect blend of science, art, and a healthy dose of the unexpected?

*Gavin Sacks, assistant professor of food science, contributed to this article.*

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